

BASIC RELATED RATES

1. A rock is dropped into a calm pond causing ripples in the form of concentric circles. The radius of the outer ripple is increasing at a constant rate of 1 foot per second. When the radius is 4 feet, at what rate is the total area of disturbed water increasing?
2. Gas is being pumped into a spherical balloon at the rate of $8 \text{ cm}^3/\text{sec}$. Find the rate of change of the radius of the balloon when the radius is 10 cm.
3. Gravel is falling in a conical pile at the rate of 100 cubic feet per minute. Find the rate of change of the height of the pile when the height is 10 feet. (Assume the coarseness of gravel is such that $r = h$).
4. A ladder 26 feet long leans against a vertical wall. The foot of the ladder is being drawn away from the wall at a rate of 4 ft/sec. How fast is the top of the ladder sliding down the wall at the instant when the foot of the ladder is 10 feet from the wall?
5. A small balloon is released at a point 150 feet away from an observer who is on level ground. If the balloon goes straight up at a rate of 8 ft/sec, how fast is the distance from the observer to the balloon increasing when the balloon is 50 feet high?
6. Two sides of a square are increasing at a rate of 3 centimeters per second. When the sides are 5 centimeters long, at what rate is the area increasing? At what rate are the diagonals increasing?

$$\begin{array}{llll}
 1. \frac{dA}{dt} = 8\pi \text{ ft}^2/\text{sec} & 2. \frac{dr}{dt} = \frac{1}{50\pi} \text{ cm/sec} & 3. \frac{dh}{dt} = \frac{1}{\pi} \text{ ft/min} & 4. \frac{dh}{dt} = -\frac{5}{3} \text{ ft/sec} \\
 5. \frac{dx}{dt} = \frac{4\sqrt{10}}{5} \text{ ft/sec} & 6. \text{ a) } \frac{dA}{dt} = 30 \text{ cm}^2/\text{sec} & \text{ b) } \frac{dy}{dt} = \frac{6}{\sqrt{2}} \text{ cm/sec} &
 \end{array}$$